Energy Conservation Challenges and Successes at Kennedy Space Center

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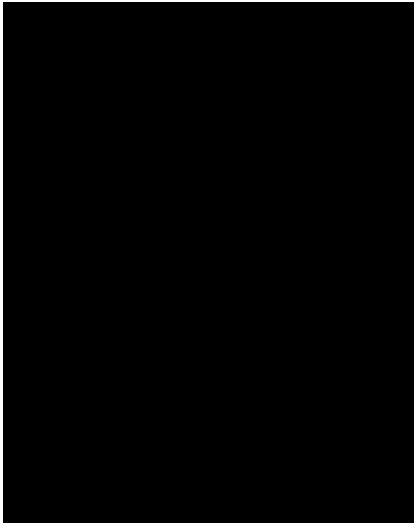
Introduction

- The purpose of this presentation is to provide an overview of the Boeing/Jacobs Sverdrup energy conservation program at the Kennedy Space Center.

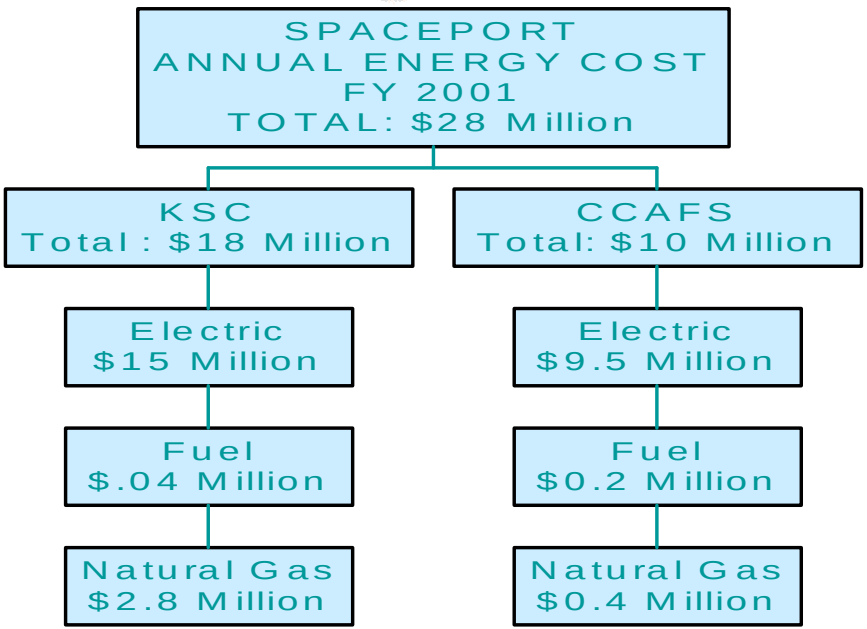
Topics of Discussion

- Kennedy Space Center (KSC) statistics.
- Boeing/Jacobs Sverdrup's roles and responsibilities at KSC.
- Background of facility types.
- Main components of Boeing/Jacobs Sverdrup's energy conservation program.
- Examples of energy conservation successes.
- Conclusions

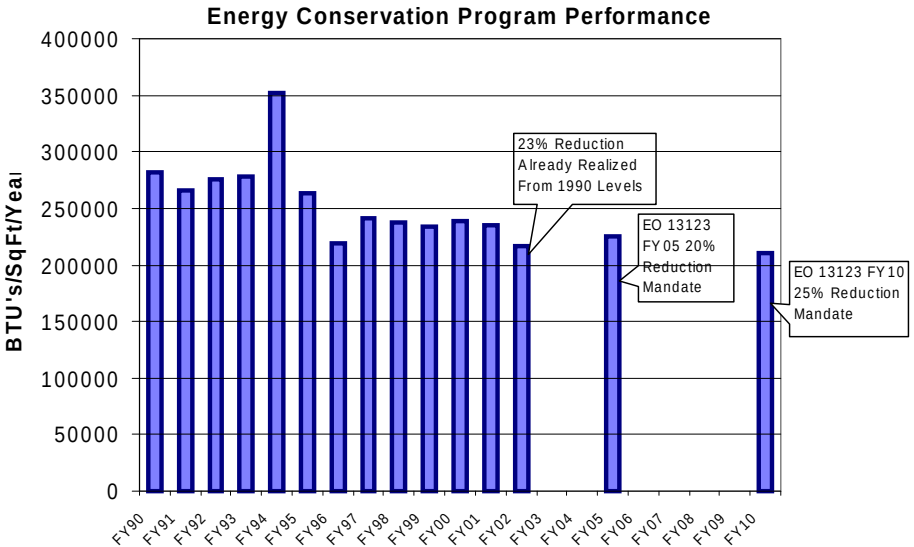
KSC Statistics



- 140,000 Acres, 6000 Acres dedicated to launch operations
- Over 200 facilities with more than 8 Million Square Feet of Occupied Space (EIF, NMV, MV)
- 2 Central Utility Plants: LC39 & KSC Industrial Area. 4 Hot/Cold Loop Systems.
- Facilities subdivided by user program SFOC (Shuttle Flight Operation Contract), CAPPS (Checkout, Assembly and Payload Processing Services), JBOSC (Joint Base Operations Contract), MILA (Merritt Island Launch Annex)
- Approximately 650 Electrical Meters


SPACEPORT
ANNUAL ENERGY COST
FY 2001
TOTAL: $28 Million
KSC
Total : $18 Million
CCAFS
Total: $10 Million
Electric
$15 Million
Fuel
$.04 Million
Natural Gas
$2.8 Million
Electric
$9.5 Million
Fuel
$0.2 Million
Natural Gas
$0.4 Million

- Boeing/Jacobs Sverdrup has energy conservation responsibility for ~1.6 million square feet.
- CAPPS facility utility expense for FY01 was $3.6 million.
- All facilities are classified as Energy Intensive Facilities (EIF).
- We have reduced energy consumption per square foot by 23% for 1990 baseline use levels, exceeding EO13123 reduction mandates. See chart.


Energy Conservation Program Performance
BTU's/SqFt/Year
400000
350000
300000
250000
200000
150000
100000
50000
0
23% Reduction
Already Realized
From 1990 Levels
EO 13123
FY 05 20%
Reduction
Mandate
EO 13123 FY 10
25% Reduction
Mandate
FY90
FY91
FY92
FY93
FY94
FY95
FY96
FY97
FY98
FY99
FY00
FY01
FY02
FY03
FY04
FY05
FY06
FY07
FY08
FY09
FY10

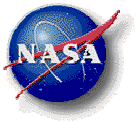
Boeing/Jacobs Sverdrup's Roles and Responsibilities at KSC

- Boeing is the Checkout, Assembly, and Payload Processing Services (CAPPS) contractor to NASA.
- Primary responsibility of CAPPS is the safe assembly, test, and checkout of International Space Station and Payload Program flight hardware.

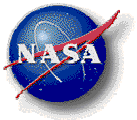
- Flight hardware flies on different launch vehicles including Space Shuttles and unmanned vehicles - Delta II, III, and IV, Atlas II and III, and Pegasus.

Background of Facility Types

- Many of the facilities at KSC were constructed 30 to 40 years ago.
- Energy efficiency was not designed into them.
- The facilities for which we have operations and maintenance responsibility mainly consist of energy intensive payload processing facilities (PPF).



- PPF's contain very large clean work areas for flight processing activities.
- Relatively stringent environmental conditions must be maintained while flight hardware is being processed.
- Florida's climate is usually warm and humid.

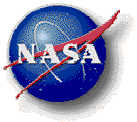


- Temperature, relative humidity, static pressure, particulate count levels must be maintained at all times.
- Because of the environmental requirements and our climate, energy consumption per square foot is usually very high.
  - **Space Station Processing Facility: 185,000 BTUs/Sq.Ft./Mo**
  - **Vertical Processing Facility: 350,000BTUs/Sq.Ft./Mo**

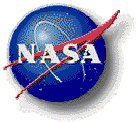
Main Components of Energy Conservation Program

- NASA cannot afford to expend large amounts of capital for the wholesale replacement of facility system equipment on the basis of energy efficiency.
- Our program focuses on three main areas:

1. Operations and maintenance (O&M) changes yield the greatest energy savings at the lowest cost. Examples are as follows:



- Temperature control system calibration procedures often identify inaccuracies in sensors that cause energy waste.
- Fine tuning and modification of control software to change the sequence of operation of HVAC systems often can yield substantial savings.
- Development of procedures that require the energy consuming systems serving a facility be placed into an “Economy Mode” by facility technicians when payload processing activities have been completed.



- Investigate how environmental conditions are being satisfied with mechanical systems. There may be ways to improve the process with improved efficiencies.
- Keep your eyes and ears open for problems communicated by your customers. Problems often times have energy inefficiencies hidden within them.

2. Challenging and changing the “way we’ve always done things”.

- Identify what the real requirements are. Require that hard proof be demonstrated for sometimes perceived requirements.
- Don’t operate systems “just in case” you need them. Risks will sometimes have to be accepted.

- If systems were designed with backup redundancy, don't operate redundant equipment just because it's available.

3. Energy efficient system retrofits.

- We condition large quantities of outside air for static pressure control requirements. Addition of outside air pre-cool coils and/or passive heat recovery coils have proven to be very effective.

- Retrofit of fluorescent lighting systems from T12 lamps and magnetic ballasts to T8 lamps and electronic ballasts have often increased lighting levels while yielding a greater than 50% energy reduction.
- Replacement of 60's vintage pneumatic temperature control systems with electronic direct digital control (DDC) systems always produce energy savings.

Examples of successes

- Operate only what is required to satisfy requirements:

  - Redundancy is typically designed into our payload processing facility HVAC systems.

  - In the past, operations personnel required all connected systems to operate while processing “just in case” of mechanical failure.

- Today, we operate only what is necessary to satisfy loads. Also have included automatic control software programs to start redundant equipment in event of failure.

- Challenge the specifications:

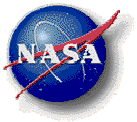
  - A requirement of 71^0F and 55% RH was levied on warehousing spaces that sometimes stored space flight components.

- In reality, there were no environmental requirements – warehousing personnel just wanted to be comfortable.

- Environmental requirements were elevated to 78^0F and 60% RH.

- Investigate how systems are functioning from an energy perspective:

- Just because environmental requirements are being satisfied, it doesn't mean the process is energy efficient.



- Recent investigation of very large air handling units revealed that pneumatic chilled water and hot water valves were malfunctioning. We were heating and cooling unnecessarily at same time. Corrections were implemented yielding over $250K/year in energy savings.

- Don’t accept requirements for their face value:

  - Recent Hubble Space Telescope servicing mission requested a 68^0F +/- 3^0F temperature setpoint. Justification was for personnel comfort, not space flight hardware requirements.

  - The customer felt we may operate to a 77^0F setpoint because we advertise normal specs of 71^0F +/- 6^0F. They did not want to perspire in clean room attire.

- Convinced customer that we would operate at 72^0F to 74^0F.

Conclusions

- The government cannot afford to spend large amounts of capital to replace inefficient equipment.
- Operating what you have, only when you need it, at the highest level of efficiency is the most cost effective form of energy management.